

Enclosure E3 (Formerly referred to as Attachment E3)

DRAINAGE LAYER DESIGN STANDARDS

1. A drainage layer overlying the entire base and the side slope of the facility must be a minimum thickness of one (1) foot and have a minimum hydraulic conductivity of not less than 1×10^{-3} centimeters per second.
2. Grain size distribution to the No. 200 (0.075 mm) sieve and hydraulic conductivity tests must be performed on representative samples of drainage layer for every 1,500 (2,400 tons) and 3,000 cubic yards (4,800 tons), respectively.
3. In the event that a geosynthetic drainage system (geocomposite, i.e., geotextile, geonet) (GT, GN) is proposed in lieu of one (1) foot of drainage layer, thirty (30) inches of protective cover classified as SC, SM, SW, GC, GM, GP and GW, using the Unified Soil Classification System, must be placed on top of it. Specifications of such geocomposite, where applicable, must be provided or addressed and, at a minimum, shall include but not be limited to the following information:

For Geotextile:

- Weight (mass per unit area) (ASTM D 5261);
- Grab elongation (ASTM D 4632);
- Grab tensile strength (ASTM D 4632);
- Puncture resistance (ASTM D 4833);
- Trapezoidal tear strength (ASTM D 4533);
- Permittivity (ASTM D 4491);
- Ultraviolet (U.V.) (500 Hours) resistance (ASTM D 4355);
- AOS (ASTM D 4751);
- Nature of the fibers, whether it is continuous filament or staple fibers, etc;
- Chemical compatibility of the geotextile;
- pH resistance of the geotextile;
- Polymer composition (i.e., polypropylene, polyester, etc);
- Structure of geotextile (i.e., woven, nonwoven);
- Thermal degradation and oxidation in extreme acidic conditions;
- Creep;
- Abrasion or tumble test;
- Long-term flow (clogging) test;

- Gradient ratio (clogging) test;
- Resistance to temperature;
- Resistance to bacteria (if information is available);
- Resistance to burial deterioration (if information is available);
- Other information as may be required for a specific product;

For Geonet:

- Thickness (ASTM D 1608);
- Tensile strength (ASTM D 4682);
- Hydraulic transmissivity (ASTM D 4716);
- Specific gravity (ASTM D 1505);
- Melt flow index (ASTM D 1238);
- Carbon black content (ASTM D 1608);
- Creep;
- Abrasion or tumble test;
- Chemical compatibility of geonet;
- Resistance to temperature;
- Resistance to bacteria;
- Resistance to burial deterioration;
- Other information as may be required for a specific product.

In order to verify the transmissivity of a geocomposite, a sample of geocomposite must be subjected to transmissivity testing at 1.25 - 1.5 times the estimated loading conditions of the landfill. The loading conditions must include the following loads: final cover; waste depth; daily and intermediate cover and protective cover. In the event that test results show that adequate transmissivity has not been achieved, other alternatives must be utilized. The results of such testing must be included in the as-built report, or as required by permit conditions, and modification.

In addition to the above listed information, the following information/description where applicable must be fully discussed as needed for specific products:

- Resins and the additives used in manufacturing (GT, GN);
- Testing frequency as recommended by QC/QA plan (GT, GN);
- Handling of GT and GN;
- Protective wrapping (GT);
- Storage at manufacturing facility (GT, GN);
- Storage at field site (GT, GN);
- Shipment procedures (GT, GN);
- Packaging (GN);
- Joining of Geonets (GN);
- Acceptance and conformance testing criteria, according to ASTM D 4759 entitled, "Determining the Specification Conformance of Geosynthetics" (GT);
- Placement procedures (GT, GN);

- Seaming procedures, seam types, seam test (GT);
 - Repair procedures (GT, GN);
 - Backfilling or covering;
 - Other information as may be needed to evaluate such product.
4. In the event that one (1) foot of gravel is proposed in lieu of one (1) foot of sand layer, in addition to the required protective cover (18 inches), at a minimum, a 10 oz/sq. yd. geotextile must also be placed on top of the GM to protect it from damage. At a minimum, the following information must be provided:
- Grab tensile strength (ASTM D 4632);
 - Grab elongation (ASTM D 4632);
 - Puncture resistance (ASTM D 4833);
 - Trapezoidal tear (ASTM D 4533);
 - Ultraviolet (U.V.) resistance (ASTM D 4355).
5. Other criteria/alternative design to establish the above-mentioned objectives may be allowed by the Commissioner if an equivalent or better protection is provided to human health and the environment.

This document may be modified periodically to reflect changes in methodology. If you have any questions regarding this Guidance, please contact the Solid Waste Engineering staff of this office for assistance.